

## Flight Simulation

Rotary wing aircraft are aerodynamically much more complex than fixed wing aircraft. Real time computer simulation of rotor blade dynamics for designing advanced helicopters and other rotorcraft could, until recently, be accomplished only on expensive mainframe computers.

NASA and Army researchers sought a more cost effective method of computer-modeling designs for the next generation of advanced rotorcraft, whose higher speeds, greater maneuverability, hingeless rotors and precision control systems require expanded bandwidth, real-time simulations that include structural dynamics and aeroelastics (blade flexing).

In the summer of 1990, accomplishing such simulations by parallel processing — rather than conventional step-by-step sequential processing — was explored by a research group that included NASA's Ames Research Center; the Army Aeroflightdynamics Directorate; and Advanced Rotorcraft Technology, Inc. (ART), Mountain View, California.

ART expanded an already-detailed blade element model in which the rotor blades are divided into a number of small segments and the action of each segment calculated. This simulation model was demonstrated in real time on two commercial parallel processing computers. Both computers were interfaced with the Army's Crew Station Research and Development Facility (located at Ames) to judge



human pilot interaction (**left**). The experiments showed that the new software architecture could provide real time simulation of high performance rotorcraft that closely matched actual flight performance at substantially lower computational cost.

Advanced Rotorcraft Technology used the simulation technology developed for the NASA/Army demonstrations, together with parallel processing technology acquired under an earlier Department of Defense contract, to develop the FLIGHTLAB system, now offered commercially as a design/analysis tool for aerospace companies or a simulation system for pilot training.

FLIGHTLAB is a turnkey system that combines object-oriented dynamic

modeling with parallel processing software support tools and state-of-the-art computer hardware to provide a total environment for simulation development, operation and engineering analysis. The heart of the system is a parallel processing workstation capable of processing sophisticated mathematical models in real time. FLIGHTLAB includes Engineer's and Programmer's Workstations that provide on-line design analysis and software checkout, and a Pilot's Workstation that enables pilot evaluation of a design early in the design process. FLIGHTLAB advantages, officials say, are less expensive computer operations and a substantial reduction of the time required for the aircraft design process.

*A software system allows real time computer simulation of rotor blade dynamics for designing advanced helicopters and other rotorcraft*